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SOME ASPECTS OF THE FOREST SOILS GENESIS FROM THE FOREST-STEPPE OF THE REPUBLIC OF MOLDOVA

Valerian CERBARI, Tamara LEAH

Institute of Soil Science, Agrochemistry and Soil Protection "Nicolae Dimo", 100 Ialoveni Street, 2070, Chisinau, Republic of Moldova

Corresponding author email: tamaraleah09@gmail.com

Abstract

The genesis of contemporary soils, formed under the vegetation of deciduous forests, grey and brown soils, as well as their evolution over time as a result of long-lasting climatic oscillations and anthropogenic impact, are treated differently; some of their peculiarities in different climatic subzones of the Republic of Moldova are not always taken into account when developing their classification. Taking into account the recommendations of the World Reference Base of Soils to name high-ranking soil taxonomic units (at the type level) in one word, in the proposed classification system, forest soils have now been renamed as: xeroforestry chernozems, greyzems, brownzems. Moldova is located at the intersection of three biogeographical areas whose natural conditions have a decisive impact on the evolution of all components of the environment, including soils. The anthropic use of forest soils in arable lands causes unprecedented changes in landscapes, ecosystems and environment, and the current climatic situation corresponds to the formation of chernozems throughout Moldova.

***Key words**: xeroforestry chernozems, climate change, pedogenesis, forest steppe.*

INTRODUCTION

Moldova is located at the intersection of three biogeographical areas whose natural conditions have a decisive impact on the evolution of all components of the environment, including soils. At the same time, the anthropogenic use of soils in forest lands has led to unprecedented changes in the landscapes of ecosystems and the environment.

The beginning of the soil cover formation on the Republic of Moldova territory refers to the border between the Pleistocene and Holocene periods (Адаменко и др., 1996). After this time, as a result of climate change and geographical areas, Moldova's forest-steppe soils have undergone a series of development stages, that were most prominently reflected in their profiles during the transition from the cold steppe to forest, or from the forest to the semi-humid or semi-arid steppe, which led to the formation of the polygenetic soil cover (Александровский, 1988, 2006; Florea, 2005; Leah & Cerbari, 2021).

The genesis of contemporary soils formed under deciduous forest vegetation, recently called greyzems, brownzems, xeroforestry chernozems and those progressed in arable chernozems from deciduous forest soils, as well as their evolution over time as a result of long-term climatic oscillations, anthropogenic impact, population migration (Xenopol, 2006) is treated differently. Some of their genetic peculiarities in different climatic subzones of the Republic of Moldova are not always taken into account at the soil classification (Cerbari, 2008; Cerbari & Lungu, 2011; Florea et al., 1987; Florea & Muntean, 2003; Ursu, 2011; Грати, 1977).

Contemporary climatic conditions throughout the Republic of Moldova correspond to the formation of chernozems (Крупеников, 1967). This is also confirmed by the spread in the north part of Moldova of the cambic and luvic arable chernozems progradated from the postarable greyzems, initially formed under the deciduous forests.

Taking into account the recommendations of the World Reference Base of soils (2014) to name top-level soil taxonomic units (at the type level) in one word, in the actual soil classification system proposed, that forest soils have been named now as follows: greyzems, brownzems, xeroforestry chernozems (Cerbari, 2008; Ursu, 2001; 2011).

MATERIALS AND METHODS

The study objects were greyzems (grey soils), brownzems (brown soils) and xeroforestry chernozems, natural (virgin) and anthropogenic modified from the forest-steppe of Northern, Central and Southern Moldova. The properties of these soils were obtained based on the pedological research materials, carried out in recent years.

In the field research, laboratory and office, the methods and the soils evaluating criteria and properties were made according to sources (Florea et al., 1987; Monitoringul..., 2010; Ghid de autoevaluare..., 2018; Cerbari, 2008; Теории и методы..., 2007; WRB, 2014).

The characteristic of greyzems properties (grey soils) was performed based on the data obtained for the soil profiles researched for soil monitoring in the 2007-2020 years on the Northen Moldavian Plateau and the Dniester Plateau. In the 2020, the virgin and arable greyzems from the northwestern part of the Northen Moldavian Plateau (Briceni) and from the Dniester Plateau (Rezina) formed in conditions of practically humid temperate climate were researched.

The north-western part (Briceni) is characterized by absolute heights within 242-284 m and a wetter climate than in the other administrative districts, located on the plateau in its eastern, central and southern part. The Dniester Plateau, being in direct contact with the Eastern European plain, is characterized by a colder climate and absolute heights within the limits of 271-351 m. In both cases, the textural differentiation of virgin greyzems is pronounced (Table 1).

RESULTS AND DISCUSSIONS

The area of soils, developed under the deciduos forest, from North to South of Moldova was formed under the influence of the following factors:

- the latitude climate zone in the northern part of the Republic Moldova with a semi-humid temperate climate (Greyzems - the sum of active air temperatures higher than 10° = 2700-2900°, the humidity coefficient Ivanov-Vâsoțchii, K = 0.7-1.0);
- the latitude climate zone in the central part of the Republic of Moldova with contrasts warm climate semi-humid to semi-arid (Brownzems - the sum of active air temperatures higher than 10° = 2900-3100°, humidity coefficient Ivanov-Vâsoțchii, K = 0.6-0.7);
- the latitude climate zone in the southern part of the Republic of Moldova with a contrast semi-arid climate (chernozems xeroforestry - the sum of active air temperatures higher than 10° = 3100-3200°, humidity coefficient Ivanov-Vashoschii, K = 0.5-0.6).

The profiles of virgin soils from the forest-steppe of the Republic of Moldova shows in Figures 1-4. The values of the main physical and chemical indices of the soils formed under the deciduous forests of the forest-steppe of the Republic Moldova presents in the Table 1. Below are present a brief description of the listed types of soils formed under deciduous forests in the forest-steppe area of Moldova.

Greyzem typical on the Northern Moldova Plateau. The genesis of greyzems (grey soils) were first studied by Докучаев (1949) and Виленский (1958), Вильямс (1949) and others. The greyzem was determined as a zonal type of soil formed in the vegetation and climatic conditions characteristic of forest-steppe forests. The greyzems formation is manifested by the gradual decrease of the influence of pedogenesis podzolic process from north to south, from the area of coniferous forests with podzolic soils to the area of deciduous forests (Докучаев, 1949). The hypothesis put forward by Виленский (1957) predicts the secondary origin of grey soils (greyzems) as a result of the oscillation of the southern and northern boundary of the forest-steppe and the manifestation of the processes of degradation and progradation of greyzems. At present, these oscillations took place, but they were not large and have influenced the progression or regradation of soils on relatively small areas (Lupașcu et al., 1998; Хотинский, 1986; Чендев, 2003).

Regarding the genesis of greyzems (grey soils) in the forest-steppe area, several hypotheses have been presented into three groups:

1. Primary formation as a special type of soil, developed under deciduous forests (Докучаев, 1949).
2. Secondary formation of greyzems following the degradation of chernozem soils and the planting of woody vegetation on these surfaces (Виленский, 1957).
3. Greyzems formation from virgin (natural) podzolic soils following the development of the process of substituting the woody vegetation with the steppe and meadow grassy vegetation (Вильямс, 1949).
The authors are of the opinion that following processes participate in different proportions in the formation of the greyzems and brownzems profile: podzolic; *in situ* alteration (cambic) and lessivage - clay migration.
In conditions of percolative water regime or periodically percolative a soil profile with an eluvial horizon is formed at the top and illuvial in the middle and lower part of these soils.
The different correlation of the podzolic process, lessivage, alteration *in situ* and the humus accumulation process leads to the formation of greyzems (grey soils) and brownzems with different properties. In colder or wetter climates (humidity coefficient Ivanov-Vashoschii, K = 0.8-1.0) under the deciduous forest, the podzolic process becomes more intensive and typical greyzem is formed, rarely - greyzems albic.
In contrast thermal conditions, characteristic for loamy-sandy soils on the Codrii Plateau (altitude 200-400 m) and the clayey-loamy soils of the hilly periphery of the Codrii (altitude 170-200 m) the brownzems are formed, textural differentiated under the action of the *in situ* alteration process and lessivage. The contemporary soils of the forest-steppe of Moldova are mostly polygenetic, their formation evolving through different phases of pedogenesis.
The typical virgin greyzem from the north-western part of the Northern Moldova Plateau (Figure 1, profile 11) has a type profile: *AEhț (0-8 cm) → AEh (8-29 cm) → EBhtw (29-47 cm) → Btw (47-68 cm) → BCtw1 (68-96 cm) → BCtw2 (96-110 cm) → Ck (110-130 cm).* The soil characterized by a differentiated texture by the eluvial-illuvial process of pedogenesis. The index of textural differentiation (Idt) of the profile of these soils for the illuvial horizon, compared to the eluvial horizon, reaches values 1.7-1.9. Soils with such Idt values are evaluated as moderately texturally differentiated soils.

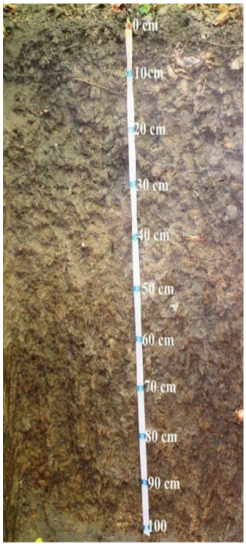

Figure 1. Profile 11. Greyzem typical, moderately humic with semi-deep humiferous profile, semi-deep clayey-loamy, moderate differentiated textural, virgin (altitude 258 m, oak and carppen forest, Briceni)

Figure 2. Profile 12. Greyzem albic, stagnic slitized, gleyzed from the surface, clayey-loamy 0-37 cm, loamy-clayey 37-80 cm, strongly differentiated textural (altitude 249 m, hornbeam forest, Rezina)

Textural division of the typical greyzem (profile 11), located in the northwestern part of the Northern Moldavian Plateau, occurred under the full action of the three processes: *in situ* alteration; lessivage of the alteration colloidal material; podzolic process - migration of water-soluble organo-mineral compounds of Fe and Al on the profile.
In this concrete case, the main role in the textural differentiation of the researched soil profile, returns to the podzolic process (Rode, 1984). Indirect, this is also confirmed by the value of pH_{KCl} = 4.1-4.3 which indicates for the eluvial and illuvial horizons in the depth range 8-96 cm a strong and very strong aggressive acidity (Table 1).
At the same time, the values of hydrolytic acidity in the depth range of 8-96 cm are medium and vary within the limits of 4.1-5.9 me/100 g soil.

The color of the eluvial horizons of the soil is grey and the iluvial horizons - dark brown (Figure 1) as a result of hemosorption and formation on the particles surface of film from the organo-mineral compounds of Fe and Al, dissolved in water (chelates). Illuviation of iron and aluminum chelates is the main process involved in the pedogenetic process of podzolization of these soils (Cerbari, 2001).

According to the data presented in Table 1, the thickness of the humeferous profile is 47 cm, the humus content in the genetic horizons can be appreciated as follows: AEhț 0-8 cm - high content; AEh 8-27 cm - submoderate content; EBhtw 27-47 cm - small content.

Greyzem albic on the Dniester Plateau. The virgin stagnic albic greyzem (Figure 2, Profile 12) was located on the horizontal surface of the Dniester Plateau in a hornbeam forest. Absolute altitude - 249 m. The soil is characterized by profile type: *AEhț (0-5 cm) → AEhg (5-20 cm) → BEhtg (20-37) → Btwg1 (37-60 cm) → Btw2 (60-80 cm) → BGtw (80-100 cm) → Cwg (100-120 cm).*

The values of the physical and chemical properties of albic greyzem are presented in Table 1. The greyzem albic is characterized by a strongly differentiated textural profile. The values of the textural differentiation index for illuvial horizons of soil are high - 19-21. The soil is characterized by high aggressive acidity which has led to the textural differentiation of its profile. The pH_{KCl} values are equal to 3.2-3.6, characteristic for manifestation of the podzolic process. At the same time, the hydrolytic acidity is very high - 12-13 me. The sum of the exchangeable cations (Ca^{2+} + Mg^{2+}) is small in the eluvial horizons and medium in the illuvial horizons.

The greyzem albic stagnic is characterized by a superficial humic profile. The humus content is very high in the organic surface layer 0-5 cm (8.00%). This layer suddenly passes into the low humic albic eluvial horizon (1.99%). The soil is leached by carbonates on the entire profile. The soil reaction is strongly acidic. Gleyzation and acidity in the local conditions of horizontal surface without leaks, temperate continental climate with humidity coefficient - 1.0, are the factors that ensured the gleyic process manifestation of Fe and Al migration and formation of the albic eluvial horizon.

Brownzem typical virgin (Figure 3, Profile 60), located on the quasi-horizontal surface, above the village of Ivancea (Orhei) is characterized by profile type: *AEhț (0-8 cm) → AEh (8-20 cm) → BEhtw (20-31 cm) → Bhtw (31-52 cm) → BCw (52-70 cm) → BCwk (70-90 cm) → BCk (90-120 cm) → Ck (120-150 cm).*

Due to the intensiv brown color of the mineral part of the soil and the weakly manifestation of lessivage, the genetic horizons of the brownzem profile are poorly differentiated.

The results for Profile 60 presented in Table 1 confirms that typical virgin brown soils are poorly differentiated texturally. The texture of these soils is clayey-loamy to loamy in the surface horizons AE and clayey-loamy to loamy-clayey in the illuvial-cambic horizons Bhtw, for which the clay content is 8-13% higher than in the eluvial horizon AE.

The decrease in the clay content in the illuvial horizon AE is due to its leaching in the horizons in the central part of the soil profile. Clay surplus from the illuvial-cambic horizon is formed both as a result of its leaching from the AE horizon, as well as as a result of the *in situ* alteration process (for the most part). However, the moderate *in situ* alteration of the soil material of the middle part of the profile and the poor leaching of the colloids from the top of the soil led to poor textural differentiation of the profile and the coating of soil particles with iron hydroxide films.

Lack of iron and aluminum in lysimeter water (Грати, 1977) confirms the very weakly manifestation in these soils of the podzolic process. According to the data, typical virgin brownzems is characterized by favorable physical properties in the surface layer 0-30 cm and unfavorable in the cambic illuvial horizon. Apparent density in this horizon, usually varies in the range of 1.60-1.65 g/cm^3, which leads to a worsening of its quality and often at the manifestation of the stagnant gleyzation.

The soil reaction is slightly acidic in the AEhț horizon (pH = 6.6); strongly acidic in the AEh horizon; slightly acidic in the BEhtw, Bhtw, BCw horizons; weakly alkaline in the BCk and Ck horizons. The carbonates in the form of bieloglasca and vines are contained in the limits of 12.5-24.4% in the horizons BCk and Ck, starting with a depth of 70 cm.

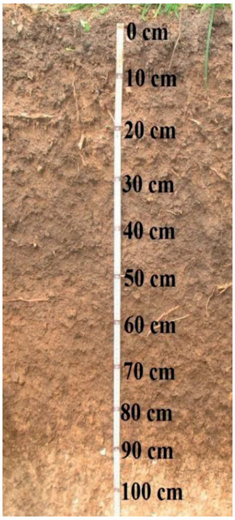

Figure 3. Profile 60. Brownzem typical, submoderate humic with semi-deep humiferous profile, clayey-loamy, poorly differentiated textural, virgin (altitude 197 m, oak forest, Orhei)

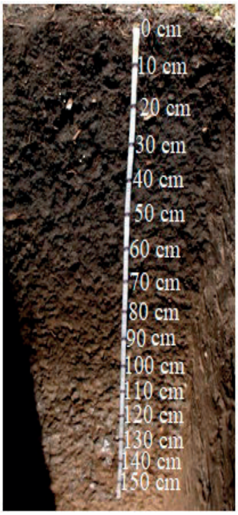

Figure 4. Profile 17. Chernozem tipical, humic with deep strongly humiferous profile, clayey-loamy, virgin (altitude 160 m, fluffy oak forest, Anenii Noi, Calfa and Hîrbovăț)

The soil is characterized by a semi-deep humiferous profile (thickness about 50 cm). The humus content on the soil profile varies from 8.99% in the horizon 0-8 cm up to 1.35% in the iluvial horizon at a depth of 30-52 cm.

Chernozems typical virgin from the xerophytic deciduous forests of southern Moldova. These soils widespread in the southern part of Moldova with a recently semi-arid climate were first described by Крупенников (1967) and called "chernozems xeroforestry" (Ursu, 2011) described these soils under fluffy oak forests with specific grass cover.

Considering the morphological composition of these soils, according to recently characteristic for typical chernozem, was called typical moderately humiferous chernozems (Ursu, 2011). The word "xeroforestry" is not coerspund to the soil subtype level. However, the humus content within the range of a soil subtype is an index with very large spatial variation.

The typical chernozems from the southern semi-arid area of Moldova are spread over several large areas (the periphery of the Tigheci height with an altitude of 130-190 m), which gives the possibility to appreciate this territory as the beginning of the forest-steppe zone in Republic of Moldova.

Note that chernozems cannot evolve in any forest. Thus, we assume that the invasion of the semi-arid area of southern Moldova of the fluffy oak forest took place in the Little Ice Age between 1250-1850s, when there was a severe cooling of the climate in Europe. In the Little Ice Age the winters were very cold with a lot of snow, and the summers were wetter than now. This led to the invasion of forests on the already existing areas of ordinary chernozems. The microclimate formed by the forest with grassy vegetation contributed to the progradation of common chernozems into typical chernozems.

The characteristic of chernozems formed under xerophytic forests in south-eastern Moldova (Figure 4) were based on data obtained for soil profile 17, located in the forest near Calfa commune, south-eastern Moldova, which is a specific ecological niche.

The primary denudation surface of this alluvial territory was formed in the late Pliocene. Recently, this surface has altitudes of 150-200 m and represents a slightly ondulating plain and at the same time strongly fragmented towards the Dniester valley and its tributary valleys.

Surface rocks are composed of Quaternary loessoid deposits with a thickness of 2-5 m to 20 m, followed by Pliocene alluvial deposits. The loessoid clayey-loamy deposits are characterized by a high content of the coarse dust fraction that ensures a positive impact on the soil physical and mechanical properties.

The deep valleys of small rivers running from the northwest to the southeast serve as passageways for raindrops formed over the Black Sea. The heights surrounding these valleys stop the movement of moist air masses. As a result, the humidity regime on these heights is quite favorable and large fragments of xerophytic forests (Hârbovăţ forest) have still been preserved here. In the southern area warm semi-humid - dry. Solar period - 310-320 days. Duration of insolation - 2200-2300 hours. Average annual temperature - 9.5°-10°C. The sum of t°C>10° - 3100-3300°. Annual amount of precipitation - 500-550 mm. Potential evaporability - 850-900 mm.

Table 1. Physical and chemical properties of soils formed under deciduous forests in the forest-steppe of the Republic of Moldova

Depth, cm	Fractions particle size, mm; content, %		Index of textural differentiation	Apparent density, g/cm^3	Humus, %	$CaCO_3$, %	pH	pH_{KCl}	Hydrolytic acidity, me/100 g soil
	<0.001 mm	< 0.01 mm							
Profile 11. Grizem typical, moderately humiferous with semi-deep humiferous profile, semi-deep clayey-loamy 0-47 cm, loamy-clay in depth. moderately texturally differentiated, virgin									
AEhț 0-8	20.6	46.4	**1.0**	1.09	5.61	0	5.9	5.6	5.7
EAh 8-27	21.5	48.1	**1.0**	1.17	2.24	0	5.6	5.0	5.9
Ebhtw 27-47	28.7	50.7	**1.4**	1.40	1.10	0	5.6	4.3	5.0
Btw 47-68	36.3	63.0	**1.7**	1.61	0.83	0	5.8	4.1	4.8
BCtw 68-96	37.7	61.6	**1.8**	1.64	0.47	0	5.9	4.3	4.1
Ctw 96-110	39.7	61.6	**1.9**	1.63	0.42	0	7.0	6.0	1.1
Cwk 10-130	37.6	6.4	**1.8**	1.59	0.41	5.9	7.0	-	-
Profile 12. Grizem albic, slitized stagnic, gleyzed from the surface, clayey-loamy 0-37 cm and loamy-clay 37-80 cm, strongly differentiated textural, virgin									
AEhţg 0-5	17.9	41.6	**1.0**	0.85	8.00	0	5.7	5.2	11.4
AEhg 5-20	24.2	45.3	**1.0**	1.35	1.99	0	4.4	4.5	13.5
Ebtwg 20-37	34.0	56.2	**1.4**	1.61	0.57	0	4.8	4.4	12.9
Btwg 37-60	46.0	62.0	**1.9**	1.64	0.58	0	4.9	3.4	13.8
Btwg 60-80	50.6	63.6	**2.1**	1.66	0.59	0	5.0	3.3	12.5
Gtw 80-100	44.2	57.4	**1.8**	1.63	0.29	0	4.6	3.5	12.4
Gtw 100-120	40.6	54.4	**1.7**	1.61	0.24	0	4.7	3.5	12.0
Profile 60. Brunezem typical submoderate humerous with semi-deep humiferous profile, clayey-loamy, weakly differentiated texturally, virgin									
AEhţ 0-8	26.3	48.3	**1.0**	0.81	8.99	0	6.6	-	1.9
AEh 8-20	27.1	49.7	**1.0**	1.16	2.77	0	4.9	-	11.7
BEht 20-30	34.6	54.7	**1.3**	1.38	1.88	0	6.5	-	4.1
Bhtw 30-52	39.8	58.4	**1.5**	1.58	1.35	0	6.2	-	3.2
Bw 52-70	35.5	58.5	**1.3**	1.60	0.88	0	6.3	-	2.9
BCwk 70-90	32.6	56.4	**1.2**	1.58	0.84	12.5	7.5	-	0
BCk 90-120	26.2	49.6	**1.0**	1.55	0.78	24.4	8.0	-	0
Ck 120-150	20.0	38.1	**1.0**	1.48	0.27	24.0	8.0	-	0
Profile 17. Chernozem typical clayey-loamy with a strongly deep humiferous profile texturally undifferentiated, virgin (xerophytic deciduous forest in southern Moldova)									
Ahţ 1 0-12	29.8	50.5	**1.0**	1.06	6.30	0	7.0	-	1.5
Ahţ2 12-27	31.6	52.5	**1.1**	1.20	4.97	0	6.9	-	1.8
Ah 27-47	32.9	53.3	**1.1**	1.32	3.60	0	6.9	-	2.2
ABh 47-67	33.9	53.3	**1.1**	1.45	2.63	0	6.8	-	2.0
Bhk1 67-90	34.4	53.2	**1.2**	1.45	1.80	2.8	7.4	-	0
Bhk2 90-109	34.5	53.9	**1.2**	1.45	1.46	9.0	8.0	-	0
BCk 109-130	34.4	54.9	**1.2**	1.44	1.00	12.5	8.2	-	0
BCk2 130-150	34.7	55.3	**1.2**	1.44	0.82	13.9	8.1	-	0
Ck 150-200	34.4	55.4	**1.2**	1.40	0.65	11.5	8.0	-	0

Hydrothermal coefficient after Ivanov-Vashotskii, K = 0.55-0.65. Duration of the vegetation period - 179-187 days. Frequency of droughts - 2 times in 10 years.

The typical chernozem (virgin) from Hârbovăţ forest is characterized by a type profile: *Ahţ1 (0-12 cm) - Ahţ2 (12-30) cm - Ah (30-47 cm) - ABh (47-67 cm) - Bh1 (67-90 cm) - Bhk2 - BCk1 - BCk2 - Ck* (Figure 4).

Effervescence - from 90 cm. Carbonates in the form of pseudomycelias - from 90 cm, rare accumulations of bioglobulin - from 180 cm The physical and chemical properties of the chernozem are presented in Table 1.

The content of physical clay on the soil profile is quite homogeneous and varies in the limits of 50.5-54.9%, and of the clay itself varies in the limits of 29.8-34.7%.

According to the values of the apparent density, the typical chernozem is very loose in the horizon Ahț1 (0-12 cm), loose in the horizon Ahț2 (12-27 cm), non slitizated in the horizon Ah (27-47 cm), weakly compacted in the horizons ABh, Bhk1 and Bhk2 in depth range 47-100 cm.

This soil is characterized by excellent physical quality. According to the humus content, the researched soil is deeply humic, leached by carbonates to a depth of 67 cm, pH_{H_2O} value = 6.8-7.0. This soil, according to the values of the listed properties, has a very high potential fertility (Table 1).

CONCLUSIONS

Silvosteppe on the Republic Moldova territory practically extends over most, from North to South under deciduous forests the following types of soils have been highlighted: greyzems; brownzems; typical chernozems.

Typical virgin greyzems, browzems and chernozems, formed under deciduous forest vegetation on the Republic of Moldova territory are polygenetic soils and have undergone various phases of pedogenesis as a result of climate change in the Holocene, anthropogenic impact (deforestation and arable land use; nomads, the disappearance of agriculture and the restoration of secondary steppe grass vegetation on former arable land, the invasion of fluffy oak forests on chernozems formed under the steppe vegetation of southern Moldova and their progression to typical chernozems with deep humiferous profile was short glacier).

The textural differentiation of the typical greyzem profile from the northwestern part of the Northern Moldavian Plateau occurred under the integral action of three pedogenesis processes: alteration *in situ* of the soil material; leaching of the colloidal material of the alteration.

The formation of brownzems on the Codrii Plateau is due to the synergistic action of the contrasts semi-arid climate in the atmosphere during the warm period of the year for the local latitude and the specific climate in the loamy-sandy soil. The high sand content sufficiently increases the aridity and contrast of the hydrothermal regime in this soil.

In the hydrothermal conditions of the Codrii Plateau on the parent clayey-loamy rocks, rarely found here, due to the fact that these rocks do not increase the aridity of soil, greyzems and not brownzems were formed.

Iron plays an important role in the genesis of soils in the forest-steppe zone: it is the third element in the soil by content, compared to other elements and, possessing the property of changing its valence and properties, is a diagnostic feature of the direction of pedogenesis. and soil subtype; determines the color of the soil, conditioned by the degree of hydration of the iron as a result of the modification of the hydrothermal regime, it has the property of changing its valence and properties, it represents a diagnostic character of the pedogenesis direction of the soil type and subtype; determines the color of the soil, conditioned by the degree of hydration of the iron as a result of the change of the hydrothermal regime.

In the field the greyzems and the brownzems are different: the typical virgin greyzems are characterized by the light color of the eluvial horizon and the dark brown of the illuvial horizon, as a result of the covering of the soil particles with organo-mineral films of the iron chelates of 100-120 cm; typical virgin brownzems are characterized by a light brown color of the eluvial horizon and a brown or reddish-brown color of the illuvial-cambic horizon, the carbonates appear deeper than 70-100 cm of profile.

In order to increase the flow of organic matter in arable grey soils and brown soils, it is necessary to organize legume seeds (autumn or spring vech and peas) for use as green manure in the agricultural sector of Moldova (Leah, Cerbari, 2020).

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